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Observations on a twin pregnancy in the African Long-tongued Fruit Bat (*Megaloglossus woermanni*) [1])

By

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Introduction

The literature is quite scanty on twinning in bats. Twinning had not previously been reported in *Megaloglossus woermanni*, however, it has been reported in several species of Microchiroptera. Barlow and Tamsitt (1968) point out that twinning is common in northern bats but rare in tropical species of Phyllostomatidae. They reason that twinning is more frequent in bats from temperate climates due to the pronounced change in seasons and thus the restricted growing season, while bats from tropical areas have a constant supply of food which promotes year round reproduction; however, there is no proof for this contention. There is no mention whether these are fraternal or identical twins. There has been one report of Siamese twinning in *Eptesicus fuscus* by Peterson (1969).

Materials and Methods

On a recent expedition to Africa (January 1973), Professor M. Eisentraut (Bonn), discovered a gravid *Megaloglossus woermanni* female containing two fetuses of different size. The twin embryos were investigated in order to delineate the reason for the disparity in growth.

In addition to the twin embryos another embryo was taken from an additional gravid female of the same species in order to serve as a control. The alcohol-fixed embryos were first examined externally, then dissected, and histological sections made of the various organs.

Findings

The control embryo was female, and appeared to have minimal hair growth (Fig. 1). The large twin was also female and was a black color as a

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result of considerable hair growth (Fig. 2). The smaller twin was a male and seemed to be at the same stage of development as the control (Fig. 2). After the embryos were dissected, and the weights taken (Table I) the results were compared.

Fig. 1: Control embryo

Fig. 2: Small twin - 1821 (left), large twin - 1820 (right), with placentas attached

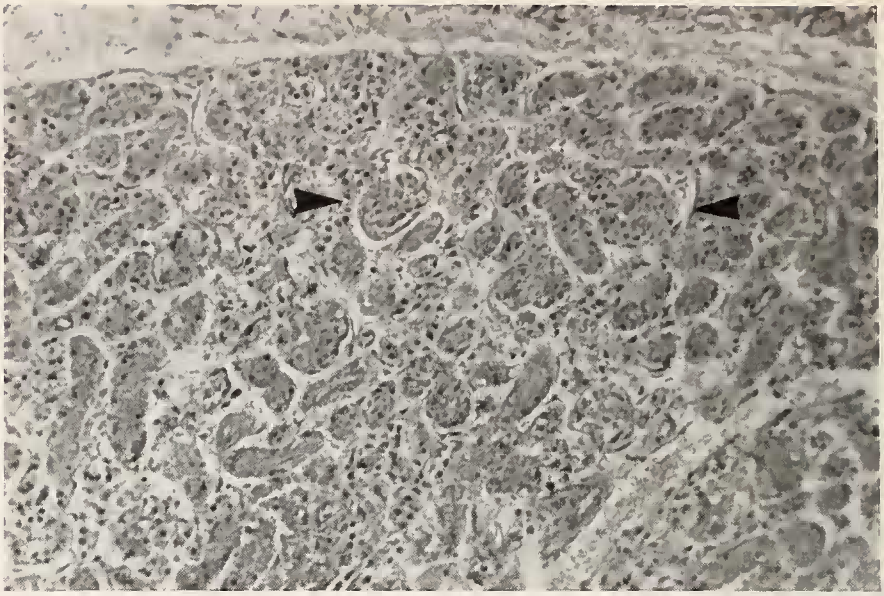

Fig. 3: Kidney section of large twin - 1820. Arrows indicate glomeruli well away from capsule (× 250)

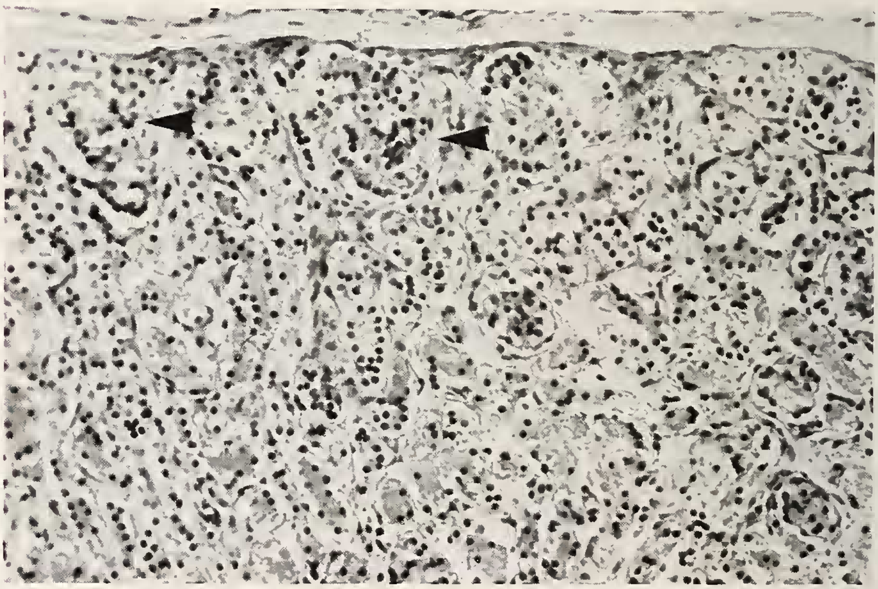

Fig. 4: Kidney section of small twin - 1821. Arrows point to active glomerulopoiesis (× 250)

Table I.

Megaloglossus woermanni	1819 control	1820 larger twin	1821 smaller twin
placenta:			
dimensions	1 cm × 1.2 cm	1.35 × 1.1	1.0 × 1.35
greatest thickness	0.4 cm	0,5	0.3
cord length	1.4 cm	1.4	1.5
weight	0.15 gm	0.40	0.29
embryo:			
head	1.1 cm × 0.9 cm	1.1 × 1.2	1.0 × 0.85
head-tail	2.15 cm	3.05	2.6
upper arm	1.1 cm	1.7	1.05
lower arm	1.2 cm	1.7	1.05
thumb	0.6 cm	0.95	0.4
second finger	0.9 cm	1.1	0.7
third metacarpal	0.9 cm	1.15	0.8
third phalanx 1	0.45 cm	0.55	0.5
third phalanx 2	0.6 cm	0.8	0.8
fourth metacarpal	0.75 cm	1.05	0.7
fourth phalanx 1	0.35 cm	0.6	0.4
fourth phalanx 2	0.4 cm	0.6	0.35
fifth metacarpal	0.65 cm	0.85	0.6
fifth phalanx 1	0.35 cm	0.4	0.4
fifth phalanx 2	0.3 cm	0.45	0.3
upper leg	0.35 cm	0.45	0.4
lower leg	0.55 cm	0.6	0.55
foot	0.4 cm	0.7	0.55
embryo weights:			
total weight	1.57 gms	3.61	1.47
heart	37 mg	71.2	18.
right lung	32.2 mg	33.2	21.2
left lung	25 mg	23	19.9
spleen	2 mg	6.4	2.6
liver	66.2 mg	70.2	50.
kidney + adrenal	11.4 mg	15	12.4
kidney + adrenal	13 mg	16	13.3
brain	175 mg	250	170.

The large twin was essentially identical in structure to the control. The small twin had the least flexible skin and its cavity was compact. The liver appeared to be enlarged, although the weights did not bear this out. The V. vitellina and A. mesenterica which connect the umbilicus to the mesentery, as described in the mouse (Theiler 1972) pass to the right of the bladder in the other two embryos but pass to the left in the runt. All other organs were in their proper places and of normal configuration. The testicles were in the inguinal canals.

The kidney of the large twin resembled histologically that of a term human infant (Potter 1972). It had no glomerulopoiesis, and all glomeruli were well away from the capsule (Fig. 3). The small twin (Fig. 4) and the control (Fig. 5) were not so advanced in their development since formation

Fig. 5: Kidney section of control embryo, showing glomeruli near surface of capsule (× 250)

Fig. 6: Placental architecture, large twin - 1820 y - yolk gland (× 16)

Fig. 7: Placental architecture, small twin - 1821 A - amnion (× 16)

of the glomeruli was still active and they were next to the capsule. The spleen of the small twin was found to be congested with blood, while the control and large twin were normal. The nuclei of all embryos were equally well preserved, for instance, the brain of the runt was not deteriorated, the grey and white matters were intact.

The placentation of the embryos resembled that described by Moghe (1951) in the Indian Fruit Bat, *Pteropus giganteus giganteus* (Figs. 6, 7). *M. woermanni* similarly has a gland which was formed from the yolk sac (Fig. 8). The placenta of the small twin was considerably congested (Figs. 9, 10). The runt was also missing its right umbilical artery (Figs. 11, 12).

Conclusions

From these findings we can speculate several things. The smaller twin may have died earlier, noting the inflexible skin and compact cavity. The possible earlier death may have been caused by heart failure since the spleen was congested with blood and the heart weight was much smaller than the controls, although, the blood volume of the heart was not determined. If the small twin had an earlier death it was not much earlier since

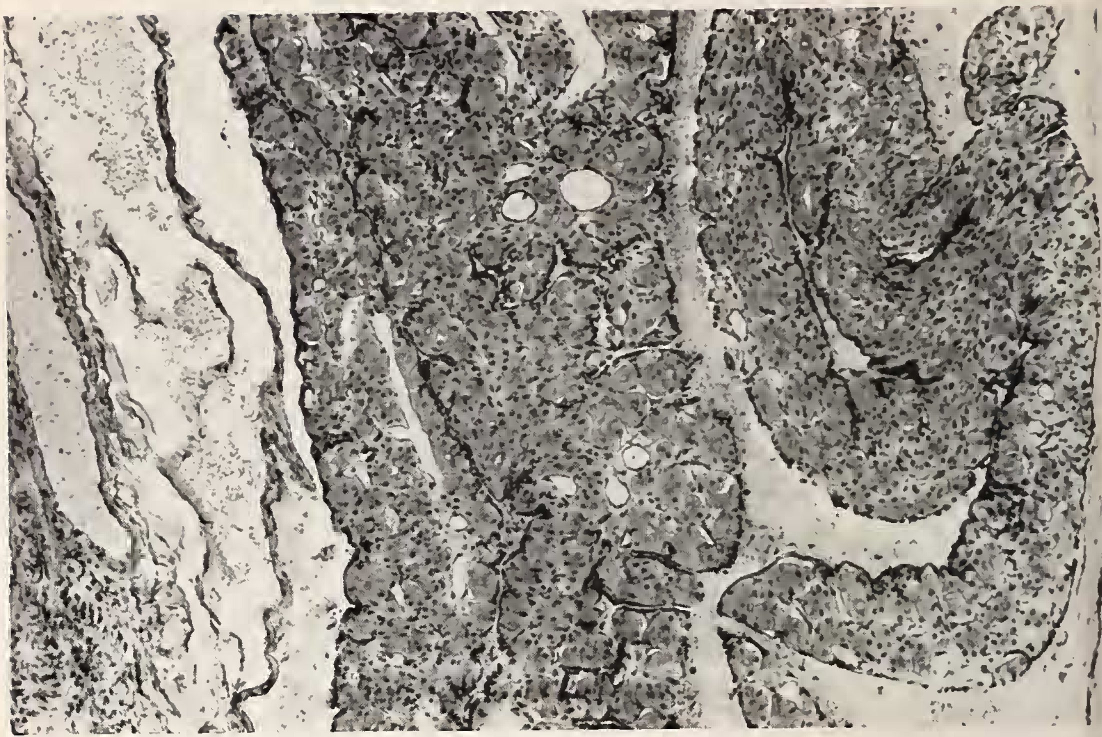

Fig. 8: Placental surface and yolk sac gland, large twin - 1820 (× 100)

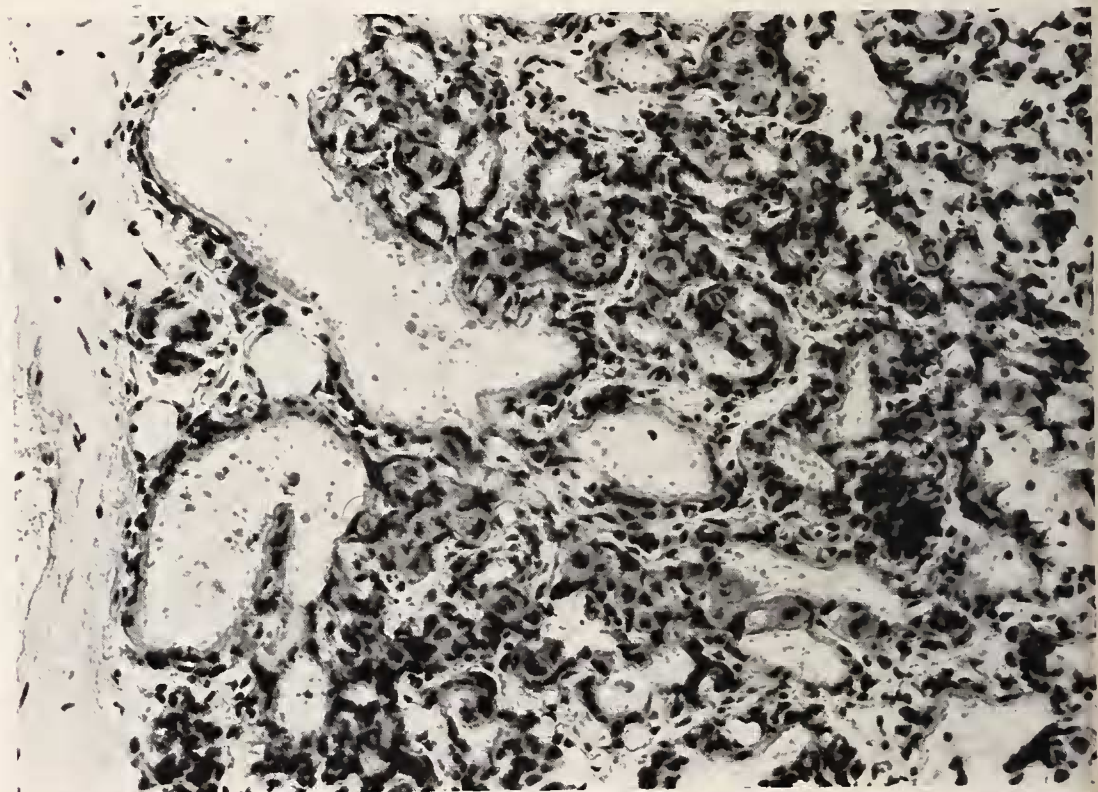

Fig. 9: Placental surface, large twin - 1820 (× 250)

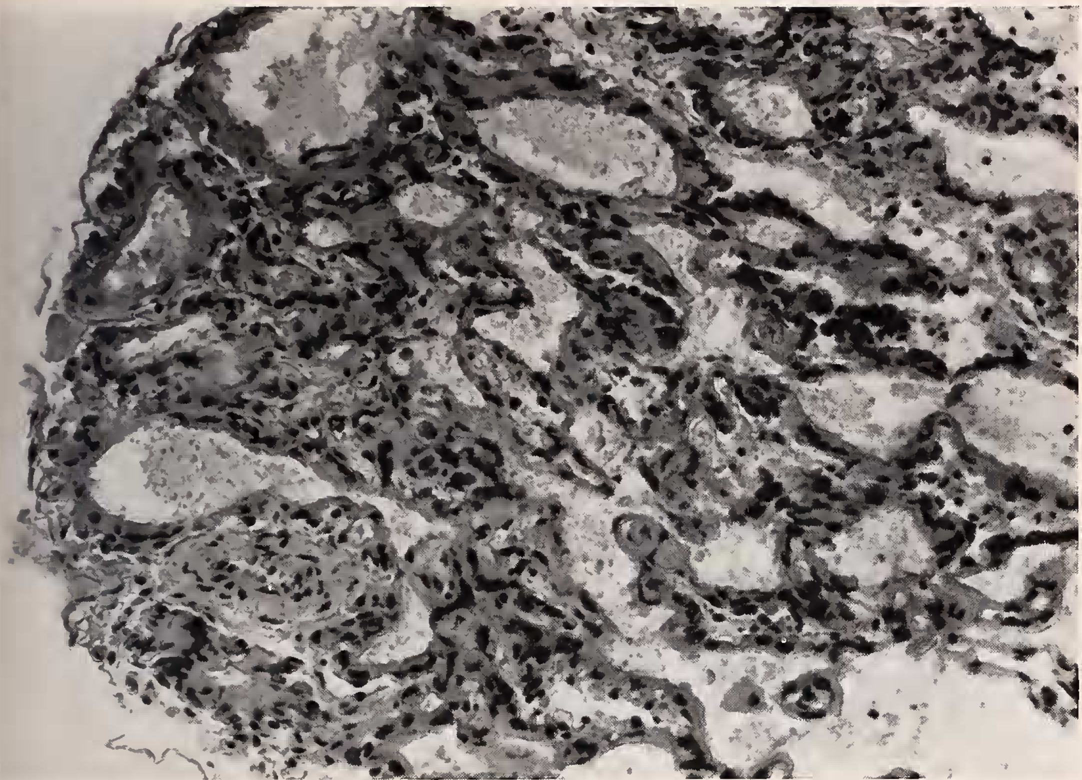

Fig. 10: Placental surface, small twin - 1821 (× 250)

the nuclei in the tissues were well preserved. The histological sections of the kidney indicate the large twin was more mature than the small twin.

The disparity in size could be due to several causes: 1) chromosomal anomaly, 2) infection, 3) differential implantation, 4) congenital defect. It was not possible to determine the karyotypes of the embryos so the question of chromosomal damage is undetermined. There was no indication of infection in the small embryo. There was no observable congenital defect save the anomaly of the missing right umbilical artery. This is indicative of defective development and occurs in 1 % of singleton births in humans but decreased growth rate was not observed in these births (Benirschke 1964). All skeletal systems were normal by roentgenography. There was no maceration of the embryos. Thus, we are left with a conclusion of differential implantation of the male fetus.

Interestingly, Ramaswami and Kumar (1963) reported a similar finding of different sized twins in *Megaderma lyra lyra*, also with the smaller twin being a male. This species likewise had no previous record of twinning. They concluded the cause of the difference in size to be due to simultaneous ovulation and fertilization, but that the female gained developmental predominance over the male zygote. From our investigation it is

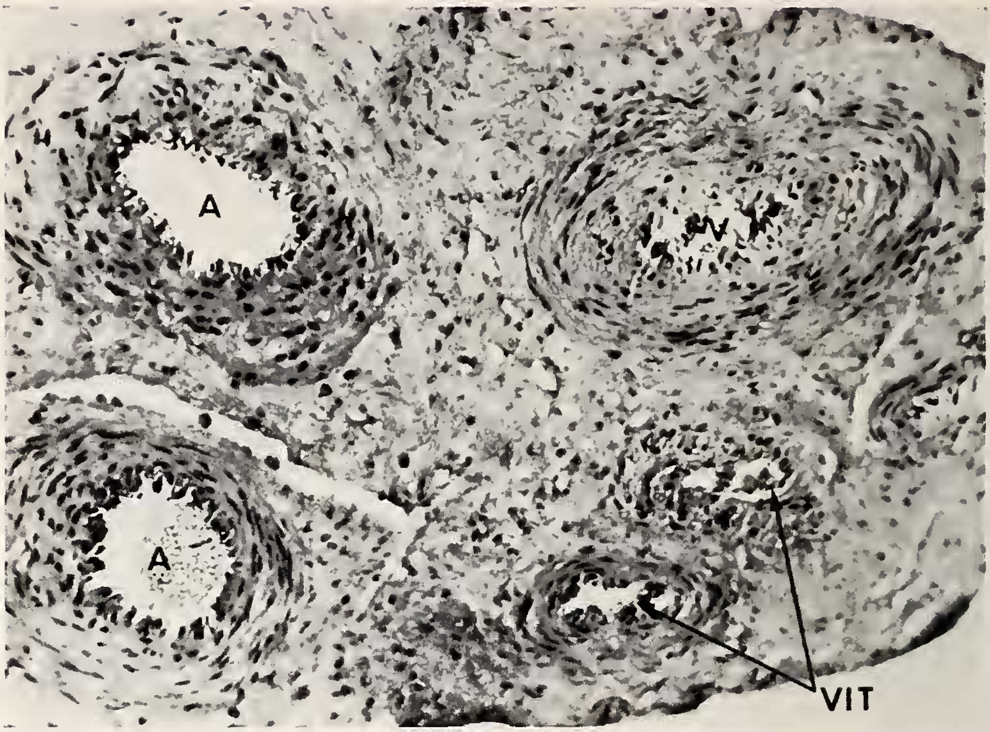

Fig. 11: Umbilical cord of large twin - 1820. A, umbilical artery V, umbilical vein Vit, vitelline vessels (× 250)

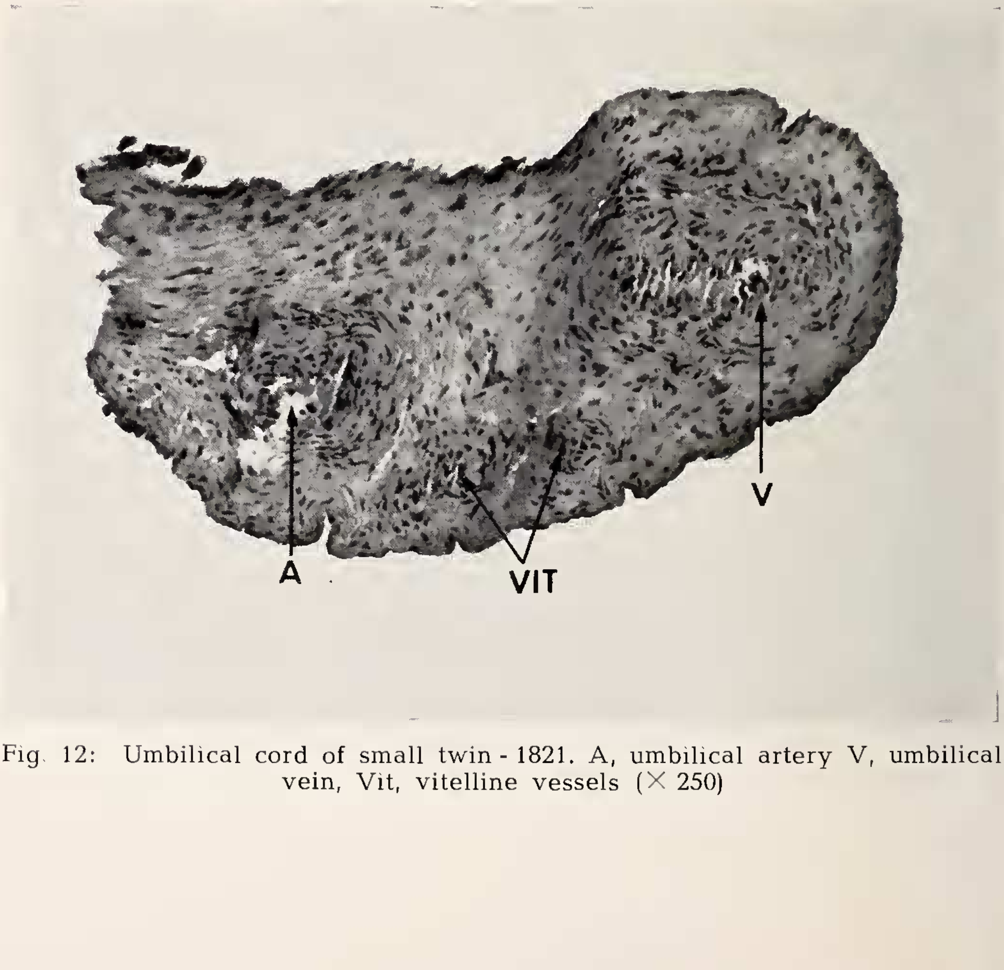

Fig. 12: Umbilical cord of small twin - 1821. A, umbilical artery V, umbilical vein, Vit, vitelline vessels (× 250)

most probable that implantation in this *M. woermanni* had occurred at two different times. This could be due to simultaneous ovulations and fertilizations with a delayed implantation of the male blastocyst, or to two separate ovulations with fertilization by either stored sperm or a second mating. In either case the result is superfetation. Since twinning is virtually unreported in Megachiroptera, it is probable we have two separate ovulations in this case rather than two simultaneous ovulations. Delayed implantation has been reported in Chiroptera singleton pregnancies (Fleming 1971) and, it can be interpreted from Marshall's paper (1953) "The Unilateral Endometrium Reaction in the Giant Fruit Bat" that in *P. giganteus* a later second implantation in the opposite horn could be possible owing to the local progesterone effect of the corpus luteum in the pregnant horn. If this is the case in *M. woermanni*, it could explain a later implantation of the second blastocyst. According to Eisentraut (1973), it seems all examined *M. woermanni* singleton pregnancies were in the left horn. In the *M. lyra* twins, the small twin was in the right horn and the large twin in the left. Unfortunately, the position of the present embryos is unknown. It is interesting to note that in some species of bats only the right ovary is functional (the left ovary is atrophic) and implantation only occurs in the right horn, while in other species the ova originate in the left ovary but implantation occurs in the right horn (Parks 1960). Since we do not know the position of the twin in this study it is not possible to make a valid speculation on ovarian function in this particular case.

Summary

This paper presents the finding of twin embryos of differing size in *Megaloglossus woermanni*. The possibilities for the cause of this unusual size difference are explored. Due to the excellent preservation of tissues in both embryos, the lack of any serious abnormalities in the small twin, and the age difference as determined by kidney sections, we have concluded the small twin to be superfetated.

Zusammenfassung

Die Arbeit beschreibt Zwillingsembryonen von unterschiedlicher Größe, die bei *Megaloglossus woermanni* gefunden wurden. Die Ursachen des ungewöhnlichen Größenunterschiedes wurden untersucht. Da bei beiden Embryonen die Gewebe sehr gut erhalten sind und bei dem kleineren Embryo keinerlei auffallende krankhafte Veränderungen zu finden sind, überdies der Altersunterschied gesichert werden konnte, ist der Schluß statthaft, daß bei der Entstehung der beiden Embryonen in jedem Falle zwei getrennte Ovulationen im Spiele waren.

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